Consider the bitstream ...0110111... taken from the bitstream 0I10I110I110I111I.... We would decode the initial part incorrectly, then would synchronize. If we had a fxed-length code (say 00,01,10,11), the situation is much worse. Jumping into the middle leads to no synchronization at all!

Solution to Exercise 6.25.1

This question is equivalent to $3p_e \times (1 - p_e) + p_e^2 \leq 1$ *or* $2p_e^2 - 3p_e + 1 \geq 0$. Because this is an upward-going parabola, we need only check where its roots are. Using the quadratic formula, we find that they are located at

$$\frac{1}{2}$$

and 1. Consequently in the range

$$0 \leq p_e \leq \frac{1}{2}$$

the error rate produced by coding is smaller.

Solution to Exercise 6.26.1

With no coding, the average bit-error probability p_e is given by the probability of error equation (6.47):

$$p_e = Q\left(\sqrt{\frac{2\alpha^2 E_b}{N_0}}\right).$$

With a threefold repetition code, the bit-error probability is given by

$$3p'_e \times (1 - p'_e) + {p'_e}^3,$$

where

$$p'_e = Q\left(\sqrt{\frac{2\alpha_2 E_b}{3N_0}}\right).$$

Plotting this reveals that the increase in bit-error probability out of the channel because of the energy reduction is not compensated by the repetition coding.